ダークマターの性質が活動銀河核の統計的性質に及ぼす役割の解明

The role of the dark matter in the statistics of active galactic nuclei

"What is dark matter? - Comprehensive study of the huge discovery space in dark matter"

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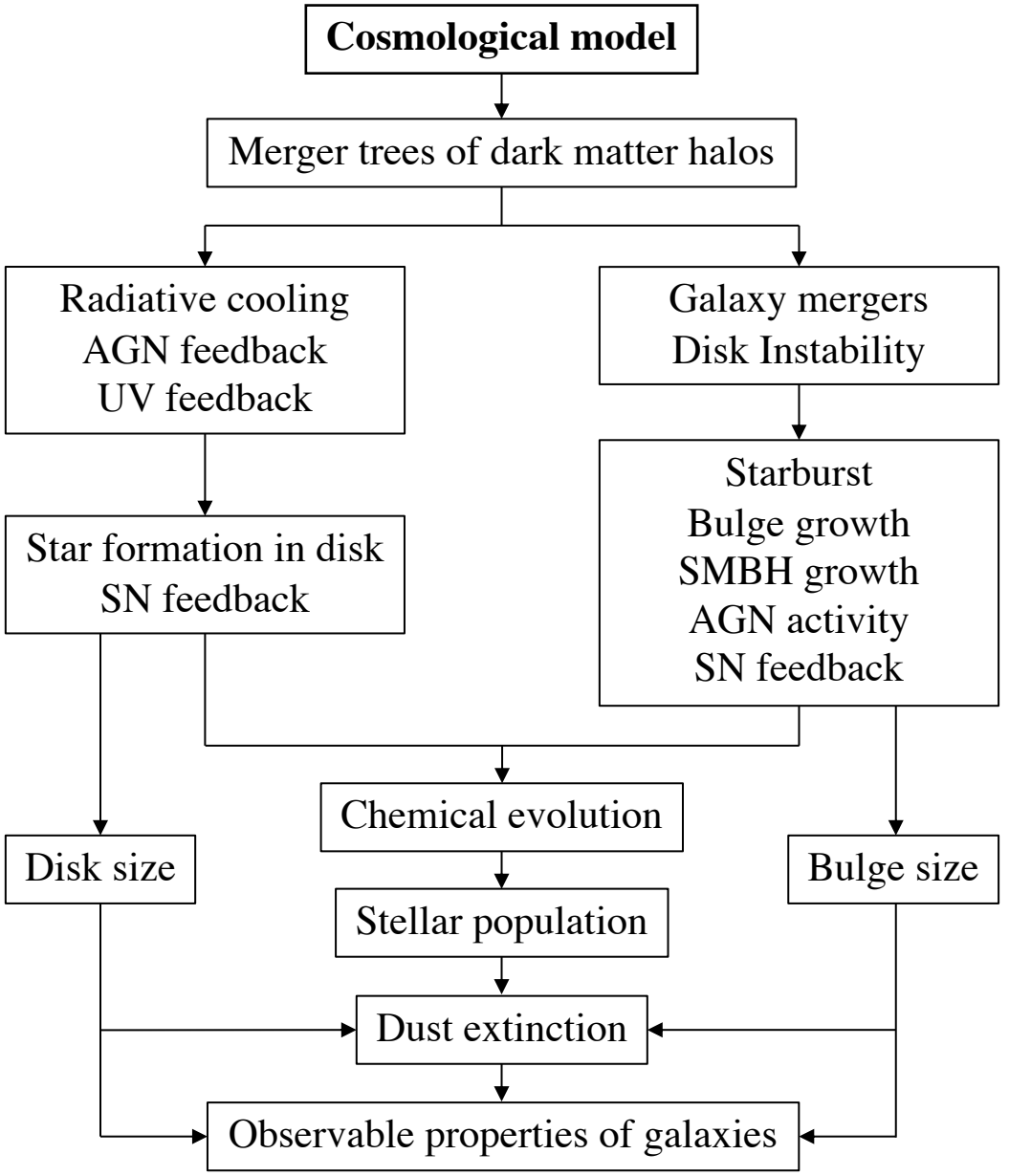
Motivation

- Warm Dark Matter (WDM) prevents the formation of low mass dark matter halos due to the free-streaming motion.
- The WDM property is likely to be significantly affect the formation of high-redshift objects, which typically reside in low mass halos.
- We investigate how different dark matter models affect the statistical observables of active galactic nuclei (AGN), one of the bright population at the high redshift Universe.

Method

1. Constructing merger trees of dark matter halos
   - Monte Carlo algorithm to generate merger trees (Parkinson et al. 2008)
   - Dark matter models
     - CDM
     - **WDM, 0.75, 1, 2 keV**
2. Semi-analytic modeling of galaxy and AGN formation
   - New Numerical Galaxy Catalog, $\boldsymbol{\nu^2}$**GC** (Makiya et al 2016; Shirakata et al. 2019)

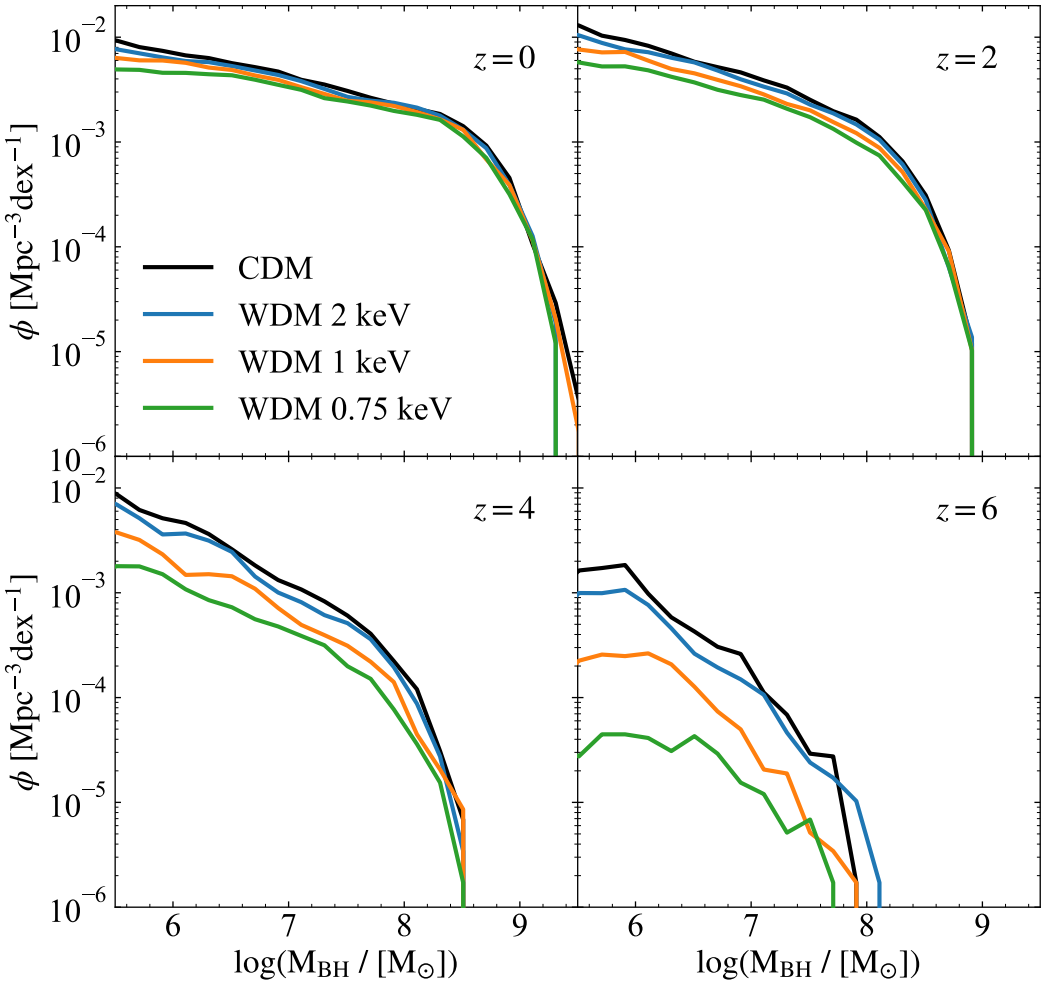
Schematics of the semi-analytic model



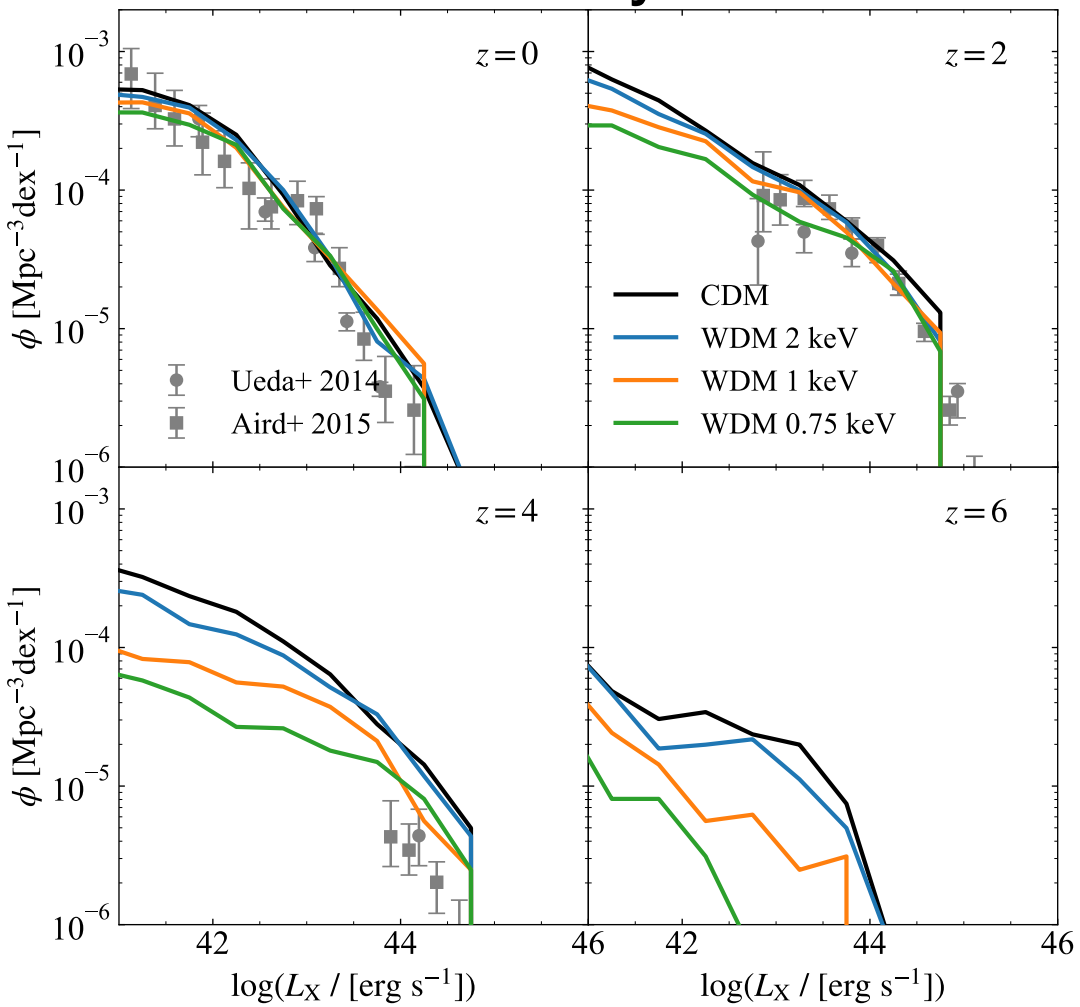
Results

Models with different cosmologies (solid lines) and observations (gray dots)

Black hole mass functions



AGN luminosity functions



The faint end of the AGN luminosity function at redshift $z \gtrsim 4$ can constrain the dark matter mass.

Summary

- By using the merger trees of CDM and WDM models combined with our semi-analytic model, we have calculated the statistical properties of black holes and AGN.
- The faint end of the AGN luminosity function at redshift $z \gtrsim 4$ can constrain the dark matter mass.
- We will study the role of the dark matter further with cosmological N-body simulations.